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than by animals, since in the animal the CO_2 escapes in the breath as a waste product, while the plant uses the CO_2 during day time for the construction of foods." There is regrettable confusion here, involving comparison of incomparable processes. Carbon dioxide happens to be a waste product in animal metabolism, but in addition to this in the case of green plants it is also food material. The contrasting of the work of respiration in the two cases upon this basis is wrong, as the author well knows. As a matter of fact, we have no reason to believe that the work of respiration as done by plant protoplasm is more economical than that done by animal protoplasm.

That this book successfully meets the demand intended to be supplied by the author is certain, and this is abundant justification for anyone who has the courage to run the gauntlet with a new book.—RAYMOND H. POND.

Evolution in the potato beetles

Although the work of Professor TOWER² on *Leptinotarsa* deals with a group of animals, his book should not be overlooked by botanists on that account. Probably no work since the appearance of DEVRIES' *Mutationstheorie* is more worthy of careful study. The contribution is essentially along experimental lines, backed by years of observation in the field and laboratory. Many of the problems, if not solved, are seen in clearer light, and at least some of the mooted questions may now be dismissed as answered. Every chapter is of interest to all schools of biologists, but there is space here merely for a few of the more important conclusions. The introductory chapter on geographical distribution and dispersion is followed by chapters on variation, coloration, habits, and instincts. Of intense interest are the final chapters, entitled "Production in experiment of races, new characters, and species in *Leptinotarsa*," and "The problem of the origin of species." The author believes that only by such careful studies may we ever hope to find out the methods of evolution; we can never solve the problem by inspection. TOWER holds that all organic variations are responses to stimuli; "the most logical interpretation is that this variation is a response of the germ plasm . . . due to stimuli which produce an inheritable variation differing in no respect in its transmissibility and permanency from the other variations produced." "Variation is . . . epigenetic and not a predetermined character in organisms." Another important conclusion is that there is no fundamental distinction between fluctuating variations and mutations. TOWER secured as good illustrations of mutation in *Leptinotarsa* as have been obtained in *Oenothera*, or better, but no hard and fast lines were to be seen separating these from ordinary variations. The "mutations" differed in that the variations exhibited greater jumps, but they did not differ qualitatively. The experiments fail to support the doctrine of unit characters. In *Leptinotarsa* also the mutations are orthoge-

² TOWER, W. L., An investigation of evolution in chrysomelid beetles of the genus *Leptinotarsa*. Carnegie Institution of Washington, Publ. no. 48. pp. 320. Washington. 1906.

netic, rather than in all directions, or even in only two directions. "I maintain . . . that mutation is not a special kind of variability . . . but it is a part of the normal variability, and the direct response of the germ plasm to stimuli." While these experiments and the conclusions of the author thus seem out of harmony with the views of mutationists, small comfort can be obtained on the other hand by Neo-Lamarckians, for there seems to be no evidence in favor of the notion of the transmission of variations that are found to arise in the soma. Even if such variations are first visible in the soma, they are possible only when the germ plasm has developed a soma capable of variation. The botanists seem to have more generally accepted the theory of mutation than have the zoologists. It scarcely seems possible that one method has been uniformly effective in animal evolution and another as uniformly in plant evolution. Very likely nature has been more multifiform in her methods than most of us have yet been willing to believe.—HENRY C. COWLES.

Vegetable physiology

A new edition of GREEN'S *Vegetable physiology* has just made its appearance from an American press.³ Unfortunately the author has not written any preface to the new edition and so what changes he has made can be ascertained only by laborious comparison of the new with the old. The alterations are more numerous than extensive, and it is evident that in large part the old plates are used. Yet the changes suffice for the incorporation of the more important recent advances in the science.

One of the most striking improvements is the transfer of the chapter on respiration from its former connection with the chapter on the aeration of plants to the chapter on the energy of the plant, so that it follows instead of precedes the discussion of food-making and food-getting, digestion, translocation, and storage. The topic might have received more thorough revision in its text to advantage. Other changes are noticeable in the discussion of the absorption of food materials, the chlorophyll apparatus, photosynthesis, and in the nomenclature and classification of proteids.

Not all of the slips have been eliminated in the revision, but the improvement is obvious in bringing the book more nearly up to date. The most striking defects which caught our attention are the retention of the filter theory of dialysis (at least by inference, for the explanation of osmosis is not very clear) and the statement that etiolin is converted into chlorophyll by the action of light. All the recent evidence is against both of these conceptions.

Of all parts of the book the chapters on irritability seem to us most in need of thorough reworking, but this has not been done. Perhaps the author was not free to make changes that would involve extensive resetting of type; as to this he does not take us into his confidence. By and large the book is one of the

³ GREEN, J. REYNOLDS, An introduction to vegetable physiology. Second edition. 8vo. pp. xx+459. Philadelphia: P. Blakiston's Son & Co. 1907. \$3.00.